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THE ESTIMATION OF FREE ACID AND OF OXYCHLORIDE SOLUTION.

By Dr. G. Romijn, 'S Hertogenbosch, Holland.

The test for oxychloride and for free acid in solution of ferric chloride as given in the Netherlands Pharmacopœia differs from that in the United States, the Belgian, and the German Pharmacopœia.

The test is this: "When a mixture of 1 Cc. of the solution with 5 Cc. of water is boiled for one minute, the liquid must be turbid after cooling."

The other pharmacopœias mentioned direct the boiling with sodium thiosulphate, with this difference: that the U. S. P. requires that no brownish-red precipitate of ferric hydroxide should separate, the other two permitting a slight precipitate.

Three of the pharmacopœias permit a slight, but not definite, amount of oxychloride; the U. S. P. proscribes this, but permits free hydrochloric acid.

With different specimens of ferric chloride solution the test of the Netherlands Pharmacopœia gives very different degrees of turbidity; I therefore endeavored to determine the acidity of the solutions.

The test of the U. S. P. could not be employed for this purpose, for when applied to a solution with free hydrochloric acid the liberated thiosulphuric acid decomposes in the hot solution into free sulphur, sulphur dioxide, and water.

At the ordinary temperature the conversion of ferric thiosulphate into ferrous tetrathionate proceeds very slowly. I have found that the reaction is very much accelerated by the addition of a few drops of a cupric chloride solution. This becomes evident by the following test: Into each of two 100 Cc. flasks place 2 Cc. ferric chloride

solution, 50 Cc. water, and 2 Cc. decinormal sodium hydroxide solution. To the contents of one, five drops of a ten per cent. solution of cupric chloride are added. After one-half hour's standing, 9 Cc. of a normal solution of sodium thiosulphate are added to the contents of each flask. Both liquids are immediately colored deep violet. The copper-free solution decolorizes very slowly; after five minutes the color is Madeira brown, and after another five minutes or more the liquid becomes almost colorless and deposits a precipitate of ferric hydroxide.

The solution containing the cupric chloride decolorizes almost instantly, and becomes turbid in a very brief space of time.

When the decinormal sodium hydroxide was replaced by hydrochloric acid a clear acid solution was obtained.

In this liquid the free acid may be approximately determined by titration, using methylorange as an indicator. The estimation is not exact, as the deposition of ferro-ferric hydroxide begins early in the operation, covering the change of color and deflecting a portion of the base from the titration. This fault may be largely overcome by adding a starch solution as protecting colloid. Other colloids may give better results or may react in such a manner as not to be serviceable for this purpose.

I have obtained good results with Kahlbaum's soluble starch and with soluble starch prepared after the method of Fernbach and Wolf.[1]

The following reagents are recommended for the estimation:

Normal sodium thiosulphate solution containing 24.8 grammes sodium thiosulphate in 100 Cc.

Cupric chloride starch. Mix one gramme cupric chloride with 49 grammes of soluble starch previously dried at 100° C.

The titration is effected as follows:

To the cooled solution of 0.5 gramme cupric chloride starch in 50 Cc. of water, contained in an Erlenmeyer flask of 100 Cc. capacity, add 2 Cc. of the ferric chloride solution to be tested. Normal thiosulphate solution is now added, 5.5 Cc. for U. S. P. ferric chloride solution and 9 Cc. for that of the P. N. IV.

The decolorized liquid is colored fairly strong with methylorange solution. If the reaction of the mixture is acid, it is titrated drop by drop with decinormal sodium thiosulphate.

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[1] *Zeitschrift f. analytische Chemie*, 1914, p. 708.

If the liquid is alkaline, it is rejected and the operation repeated after adding 1 Cc., or as much as may be required, of decinormal hydrochloric acid before adding the other reagents.

As the free thiosulphuric acid decomposes with notable rapidity, even in the cold solution, the titration should be effected rapidly. The change of color can best be observed by looking from above through the liquid onto a white foundation. Side light must be shut out.

The following results will illustrate the value of the method:

No.	Ferric chloride solution employed	With soluble starch		Without starch	
		Decinormal solution required	Aspect of the mixture ten minutes after	Decinormal solution required	Aspect of the mixture ten minutes after
1..	Prepared from sublimed ferric chloride	2.55 Cc.	Unchanged	2.55 Cc.	Very turbid
2..	Solution.....47.5 Cc. Normal NaOH.. 2.5 Cc.	1.37 Cc.	Unchanged	1.70 Cc.	Very turbid
3..	Solution..... 2.00 Cc. Water.....20.00 Cc. Decinormal NaOH..... 2.50 Cc. Complete after 30 minutes' standing	0.02 Cc.	Unchanged	0.12 Cc.	Slightly turbid
4..	.....	0.53 Cc.	Unchanged	0.70 Cc.	Very turbid
5..	.....	0.08 Cc.	Unchanged	0.12 Cc.	Almost unchanged
6..	99 Cc. No. 5 with 1 Cc. hydrochloric acid of 1.19 specific gravity	2.45 Cc.	Unchanged	2.55 Cc.	Very turbid
7..	48 Cc. No. 5 with 2 Cc. normal NaOH	0.68 Cc.	Alkaline reaction	0.25 Cc.	Very turbid

Decinormal sodium hydroxide was employed in the first six double assays; in the last double assays the mixtures, being alkaline, were titrated with decinormal hydrochloric acid.

All the solutions were according to the P. N. IV., sp. gr. 1.470–1.482.

Solution one, prepared from sublimed ferric chloride, yields a clear liquid with the test of the P. N. IV. Examined by the tests of the other three pharmacopœias, free sulphur is separated. These two tests are thus in accordance with the results in the table and show that the solution contains free acid.

This may result from the hydrolysis of the ferric chloride and the

difference in ionization between the thus formed hydrochloric acid and ferric hydroxide, or from an impurity in the sublimed salt.

A minute examination of the product, for which, however, the time was lacking, might have determined the question.

The sodium hydroxide solution added to number two was equivalent to 1 Cc. decinormal in the 2 Cc. employed. Neither with nor without starch solution is this quantity exactly found. In number three the added quantity of decinormal sodium hydroxide is very accurately found in both cases.

A much greater difference resulted between the two tests numbered seven. In the first, where starch solution was employed, 0.68 + 0.08 Cc. decinormal acid was found, a very slight difference from the added portion, which was 0.80 Cc. The titration without starch shows a considerable deficit, 0.25 + 0.12 = 0.37 Cc. only being found.

After all, I cannot assert how nearly the result of the titration corresponds with the true composition of the solution. Yet the results obtained in this simple operation may be prescribed within narrow limits. Repeated titrations give but slightly different results.

From the examination of several specimens I concluded that these limits may be formulated as follows: 2 Cc. of the solution should require no more than 1.2 Cc. decinormal sodium hydroxide when examined in the above-mentioned manner. If the mixture be alkaline toward methylorange, the addition of 1 Cc. decinormal hydrochloric acid to the ferric chloride solution should produce a mixture of acid reaction.

THE RAPID DETERMINATION OF SMALL QUANTITIES OF HEROIN.

By Reginald Miller.

This laboratory frequently receives samples of drugs for analysis among which are heroin and cocaine.

In many cases the total quantity of heroin does not exceed ¼ grain mixed with varying amounts of milk sugar and sometimes cocaine. To determine this quantity of heroin by the extraction method is extremely difficult, particularly if cocaine is present as well as heroin. A rapid method by which small quantities of heroin could be determined with reasonable accuracy was sought to facilitate these examinations.

The following method was used and found, in the absence of morphine or any other interfering substance, to be sufficiently accurate and to possess the additional advantage of being rapid.

After the presence of heroin and absence of morphine or other interfering substances are ascertained, a weighed amount of the powder is taken sufficient to contain from 1/50 to 1/20 grain of heroin. This can be roughly determined by the qualitative reactions. It is placed in a Nessler tube, and 1 Cc. of a one per cent. solution of sulphuric acid is added, and then 3 Cc. of a solution consisting of 600 Cc. of commercial sulphuric acid, 300 Cc. of water, and 25 Cc. of a 40 per cent. formaldehyde solution. This reagent will produce a coloration, varying from a yellowish straw for 1/150 grain to a deep cherry red for 1/5 grain of heroin, depending upon the length of time the reaction is allowed to proceed and the amount of heroin present.

A series of standard tubes are prepared, containing 1/50, 1/40, 1/30, 1/20, and 1/15 grain of heroin respectively (or any other suitable quantity from 1/150 grain to 1/5 grain), and each of which is treated with the reagent in the same manner and at the same time as the sample. The reaction is allowed to proceed for 10 or 15 minutes in all the tubes, when the coloration in the tube containing the sample is compared with the colorations in the standard tubes. The standard tube which has the same intensity of color as the sample contains the same amount of heroin, and from this figure we compute the total amount of heroin in the powder under examination.

If, however, a mixture of cocaine and heroin is submitted, we determine the heroin and cocaine as follows:

The substance is extracted in the regular manner by the immiscible solvents, and the residue of heroin and cocaine is weighed, and dissolved in a *known* amount of 1 per cent. sulphuric acid, so that 1 Cc. of the solution will contain between 1/100 and 1/20 of a grain of heroin. One Cc. of this solution is put into a Nessler tube and treated with 3 Cc. of formaldehyde sulphuric acid solution. The color produced is compared and measured as described. The standard tube containing the same intensity of color is used as the basis for computing the amount of heroin in the weighed residue, and the difference between the heroin and weight of residue obtained by the immiscible solvent represents the cocaine.

The following table illustrates the sensitiveness and the limita-

tion of the method. A period of 15 minutes after the addition of the reagent (formaldehyde sulphuric acid) was allowed in each of the following cases before a note of color produced was made:

1/200 grain of heroin: slight coloration produced.
1/100 grain of heroin: light reddish-yellow color produced.
1/50 grain of heroin: red-yellow color produced.
1/45 grain of heroin: deeper than 1/50 of a grain.
1/40 grain of heroin: deeper than 1/45 of a grain.
1/30 grain of heroin: much deeper than 1/40 of a grain.
1/20 grain of heroin: very much deeper than 1/30 of a grain.
1/10 grain of heroin: cherry-red color produced.
1/5 grain of heroin: deep cherry-red color produced.

I have found that a difference of 1/450 of a grain of heroin will produce an appreciable change in color when 1/50 of a grain is used, and that a difference of 1/100 of a grain of heroin will produce a very perceptible change in color when 1/20 of a grain of heroin is used.

I prepare these standards by making up several solutions of heroin in one per cent. sulphuric acid solution, and then pipetting by means of a pipette graduated in 1/100 Cc.

One solution is prepared containing 1/5 grain of heroin per Cc. Another solution is prepared containing 1/10 grain of heroin per Cc. A third is prepared containing 1/20 grain of heroin per Cc. A fourth solution is prepared containing 1/40 grain of heroin per Cc.

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RELATION BETWEEN DRUGGIST AND VETERINARIAN.[1]

By T. B. Rogers, D.V.S., Woodbury, N. J.,
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There are few things more impressive to one who, like myself, has passed the meridian of life than to stand before a class of young men in a great institution of learning and contrast their virile, though fleeting, youth with their venerable Alma Mater. For, while the students and alumni of your institution, from the irrepressible fresh-

[1] Special lecture delivered at the Philadelphia College of Pharmacy, March, 1915.

man to that lean and slippered pantaloon, the oldest alumnus, are of to-day, and to-morrow are not, a great school is as nearly as any mundane thing can be immortal.

It has a corporate existence and a perpetual succession. The fires on your altars are never quenched: each one tends them for a while, and then becomes a memory to his successor.

I am glad to address you, because pharmacy was my first love, and even to-day I occasionally find myself longing for your profession. I can sympathize with your joys and your sorrows. I have arisen at 2 A.M. with a smile on my lip and murder in my heart, to show a belated rounder the directory. I have lolled on your flowery beds of ease; "I also have dwelt in Arcadia."

My good friend, Mr. England, got a little mixed when he announced that my address would be on "Dispensing for the Veterinarian." That would indeed be carrying coals to Newcastle. My object is rather to foregather with you and suggest methods that will tend toward closer and more profitable relations between the pharmacist and the practitioner of veterinary medicine.

Some of you have heard of that now somewhat venerable "Kitchen Pharmacopœia," Mrs. Glass's Cook Book. The recipe for making hare soup commences: "First catch your hare"—sound advice beyond question.

Let us then see how best to attract the veterinarian to your establishment: What is the best bait, the best way to display it?

Perhaps it will be well to attack the negative side first and point out to you some manners and methods that, in my opinion, will not be likely to catch the veterinary fish, or, for that matter, the medical fish or any other fish whatever.

Here are a few advertisements not calculated to give me confidence in either your knowledge, sense, or good faith.

No. 1 is from a Boston drug store: "Lunches put up to take out. Baked beans, bread and butter, doughnut and coffee, 15 cents."

No. 2: "Saturday is apple day at our fountain; an apple given with every glass of soda."

No. 3: "Our 59-cent offer: One-half dozen cakes ivory soap, one-quarter pound Bunko Brand coffee, one-half dozen carriage candles, 2 pounds washing soda, one bottle Tonko Brand vanilla."

Here is a quotation from one of your journals; the article goes to show how to build up a run-down store, and I pass it on to you with

the remark that if you think the suggested method will tend to endear you to my profession, you have another think coming to you.

"Is your dog sick?
Try Dr. Soso's
Mange Cure
Distemper Cure
Bowel Regulator
Worm Eradicator."

"When Brown sold her a bottle for the dog's eczema he advised her to use Dr. Soso's sulphur tablets with it. Buying for the dog, she bought for herself (Query—'Trying it on the dog'), and one of her friends told him that the bowel regulator had saved her from taking the dog to the veterinary, and that he (certainly not the veterinary) could never know how grateful she was to him."

Now in my State of New Jersey we have, among other courts, a Court of Equity, where wrongs for which no remedy is provided by law may be adjusted, and the first requirement of this court is that a suitor must appear before it with clean hands; asking equity, he must do equity.

Now the ethics of Brown are, to put it mildly, what Carlyle calls the ethics of kites and crows. *Imprimis*: Brown demeaned his profession (for, believe me, pharmacy is a profession, or it has no reason for existence) by recommending a remedy of which he knew nothing (a secret remedy) for a disease of which he knew less.

Sarcoptic mange and distemper are rarely cured, so in order to turn a dollar into the till he has disgraced himself by alliance with a quack, has exposed a pet of more or less pecuniary and sentimental value to all the risks attendant upon ignorant prescribing, and sidetracked the veterinarian, whose business would have been a desirable asset.

If this is business, help yourselves, but don't blame the veterinarian if he comes back saying "If you take my prescription to Brown's store, get another doctor."

The veterinarian will not be attracted by a store where there is no ocular evidence of the drug business. Recently I entered a drug store on a prominent thoroughfare. One side was given up entirely to cigars and soda water, the other side and end to a mixed display. The proprietor said that the drug department was con-

centrated in the "laboratory" in order to insure the necessary quietude.

A little study of the geography of the premises demonstrated that the laboratory could hardly be big enough to swing a cat. He further assured me that he made, tested, and standardized all of his own preparations, and I thought, well! never mind what I thought.

The veterinarian is not attracted when the proprietor of such an emporium as the one I have just described assures him that the retail drug business is absolutely dead.

Nobody cares to mix up with a corpse, and I would suggest if the business is really dead then an indecent interval of time has been allowed to intervene between the demise of the dear deceased and the call for the undertaker. If the business is dead, bury it, and let us make a fresh start.

However, the retail drug business is not dead, but rather, perhaps, in a somewhat valetudinarian condition, largely due to too much concentration of attention upon its own woes.

A somewhat lengthy experience has taught me that if we look well to our duties our rights will take care of themselves, and I am of the opinion that if you young gentlemen face modern conditions cheerfully, determined to conduct the retail drug business as it ought to be conducted, the rewards will be proportionate to the endeavor. If you want our business, meet us with a smile, put out your best goods to the front, and by this I mean your pharmaceuticals. Here a few words.

The veterinarian needs the best; if you want to hold him you can't substitute "Just as good" for the best; we demand standardized and physiologically tested extracts and tinctures; we are willing to pay for quality, but you must deliver the goods. You can't put a display of the best in the window and dispense the worst in the back room.

We like to meet the proprietor, and take it kindly if we find that he is sufficiently interested in our branch of medicine to acquire a little information on the subject. We appreciate pharmaceutical information; some of us are willing to learn improved methods of prescription writing or dispensing, things the up-to-date druggist, seeing many prescriptions from many writers, is usually qualified to teach. On the other hand, the veterinarian can help the druggist in the matter of veterinary dosage, the most suitable way of administering drugs to different species of animals, and can instruct him

usefully in the matter of idiosyncrasies of the different species of animals.

Another point worth remembering when dispensing veterinary prescriptions is that a commercial element exists in the relation of the veterinarian to his patient. Save in comparatively rare instances, a veterinarian's client won't spend more on a patient than he is worth.

The veterinarian's prescriptions usually call for large amounts of often expensive drugs, and if the druggist wants to hold this business a little concession may sometimes be necessary.

Some years ago I wrote a prescription for one ounce of quinine, divided into eight powders. The dispenser charged the unfortunate race-horse owner ten dollars, and when I called his attention to the infernal overcharge I was told that his price for quinine in prescriptions was two cents a grain, and that in his opinion the dispensing charge of forty cents was most reasonable.

Don't renew the veterinarian's prescriptions without orders. If he prescribes a combination of drugs for the colic of Brown's horse, it does not follow that it is just the thing for Smith's horse; it may kill the horse, lose the veterinarian's custom and influence, and also the good-will of the horse owner.

Now it is not uncommon to hear druggists declare that the veterinarian is poor pay, and, for that reason, not a dependable customer. This is arrant nonsense. There are careless, dishonest, unscrupulous medical men, veterinarians, and druggists, but the bulk of each of these professions pay their bills; if this were not so, the manufacturing pharmacists and biologists would have to get out of business. It is the man, not the profession, that we must look to. That doctors and veterinarians are occasionally slow pay is true, but I also know that a good many druggists are on the C. O. D. lists. Believe me, you will rarely make a mistake in extending to a young, hard-working veterinarian of good habits all reasonable credit.

If I were to sit down and write all my clients who failed to remit in thirty days that I had drawn on them at sight for the amount, I should soon have no clients to draw on.

Another way to attract veterinary business is to carry a stock of veterinary biologicals. We use more biologicals than do physicians, and we often want them quickly. Almost all of us prefer to buy at home, if we are allowed to do so, and a wholesale profit on doctors'

and veterinarians' supplies comes in nicely when you consider that it can be gathered without any increase of overhead expenses.

Let us now look at the practical side: *Dispensing for the veterinarian.*

Boluses for the veterinarian should be made oblong, not round; should weigh not more than two ounces; should have a stiff, pilular consistence, and be dispensed in gelatine capsules, or, in my opinion, preferably in oiled tissue paper.

The samples I pass around among you illustrate the requirements I have mentioned. Pill masses for the dog or cat may be placed in capsules, coated (tolu makes a good coating), or, if the mass is not nauseous, may be rolled in an inert powder and dispensed plain. See to it that they are of such consistence as will insure their rolling easily off the back of the tongue; remember that a man tries to swallow a pill, a dog tries to eject it.

It may be well for you to know that if when giving a pill to a dog you grasp the muzzle in the left hand, and with the right hand give him a smart tap under the lower jaw, an automatic effort at deglutition ensues, usually resulting in the pill going down all right.

In dispensing bulk powders for veterinary use, paper boxes or cartons are to be preferred to tin, for the reason that they are not as apt to lose their labels, and it is an excellent practice to put the prescription number on the container as well as on the label. If the powders are divided they will keep in better condition if wrapped in paraffin paper, as a preventive of efflorescence or deliquescence.

Liquids should be dispensed in regular prescription ware, not in any old bottle. The drugs won't be any better; the impression made on the prescriber and owner will, however, be more favorable.

A neat japanned tin box is good enough for ointments for stable use.

When dispensing for Fido or pussy, you cannot take too much pains. Ladies who feed their pets French chops and angel cake think nothing is too good for them, and the dog and cat business is well worth cultivating.

You may from time to time have to answer the question: What is the easiest way of giving medicine to an animal?

It differs with the species.

Solids are best given to horses in bolus or made into an electuary with molasses.

Liquids should be given with a dose syringe, as there is some

danger in getting them down the trachea if the horse is drenched; and if this happens, traumatic pneumonia is the usual result. If a horse retains liquid in the mouth, a few drachms of lukewarm water poured into the nostril will always cause him to swallow, but medicine should never be thus given. Cattle may be drenched; it is as easy as pouring water down a rat hole. A nice way to give liquids to a dog is to close the jaws with a piece of tape or string and then, making a pocket of the commissure of the lips, pour in the dose and elevate the head. Pills may be given by opening the mouth by pressure where the under and upper jaw come together, dropping the pill on the base of the tongue, then allow the mouth to close, and give the dog a smart tap with the flat of the hand under the jaw. Cats will lick many preparations off their fur; in default they may be handled like dogs. If they are inclined to scratch, roll them up in a towel or apron.

The dose for animals compared with the dose for man.

Horse	30 times.
Cow	20 to 30 times.
Sheep	4 times.
Foal	About 4 times.
Pig	5 times.
Dog	About same as man.
Cat	One-half.

This table, however, is not altogether trustwothy.

The lower animals are more susceptible to the action of spinal stimulants than man. They don't stand nux vomica or strychnia as well as we do. I have seen $\frac{1}{200}$ of a grain of strychnia given to a nursing bitch produce light convulsions in her puppies, and especially should we be careful of strychnia if there is suppression or retention of urine.

Morphia often acts like apomorphia in the dog, although its secondary action is narcotic, and it often acts as an excitant to the cat; on the other hand, the horse takes opiates well. I have given a light horse a drachm of morphia in twelve hours without any unfavorable result.

Cocaine used as a local anæsthetic in canine surgery is often unduly exciting, and may well be replaced with quinine and urea hydrochloride. Most of the lower animals stand chloral well, the exception being old pet dogs with fatty heart.

For general anæsthesia, use ether for cat and dog, chloroform for the horse. It is almost impossible to etherize a horse.

The best purgative for the horse is aloes, but it must be of Barbadoes type; *i.e.,* must give a rose-red reaction with tincture of iodine in dilute aqueous solution.

Don't ask for an explanation. Cape or Socotra aloes does not give as good results, and aloin is not to be relied upon as a substitute for aloes. Don't give croton oil or gamboge to a horse unless the drugs are prescribed by a veterinarian. For cattle the salines, Epsom or Glauber salts, are the best purgatives.

Dogs get castor oil and buckthorn or cascara, and the same remedies may be given to cats.

A good, rough way to estimate the dose of aloes for the horse is to allow a thousand pounds of weight per ounce of drug, and add or subtract a drachm for every hundredweight over or under that standard.

It may be useful to know that light diet, bran mashes, etc., help the action of equine purgatives.

For superpurgation pulv. creta aromat. in two- to three-ounce doses, in whiskey and water, will be found useful.

Now I am going to touch on a somewhat mooted subject: Prescribing by the druggist.

As an old druggist, I know that if you do your whole duty to your community you must sometimes prescribe, and I am frank to say that in many cases you do so with just as much care as the doctor.

If I stop in my physician's office and tell him that I have caught a little cold, and he hands me a bottle of cough syrup, ready put up for him by a wholesaler, and tells me to take a teaspoonful three or four times daily, he is not prescribing for me more intelligently than would the druggist if he handed me a fifty-cent bottle of Jones's Pulmonic Balsam with directions printed on the label.

If a lady customer rushes in and tells you her dog has convulsions, and you prescribe full doses of bromides and order the dog wet-packed, you may help the owner, the dog, and the veterinarian.

If a customer asks for turpentine to treat a nail wound in a horse's foot you are justified in suggesting the use of an immunizing dose of tetanus antitoxin, and you can increase your business and get the good-will of your veterinary customers by posting yourself on the use of veterinary biologicals and passing on the knowledge as occasion serves. If called on to prescribe for a case of colic,

in the absence of a veterinarian, play safe. Don't give opiates. Cannabis with spt. æth. comp. and camphor will usually serve your turn and will not interfere with the veterinarian's treatment after he reaches the case.

Don't put euphorbium or sulphuric acid in a blister unless on prescription; you may permanently blemish a good horse.

In closing let me outline my ideas regarding the relations between the medical, veterinary, and pharmaceutic branches of the science and art of medicine.

If every physician and veterinarian were compelled to take a course in pharmacy as a requirement for matriculation it would be better for all concerned, and I would rather have the pharmacy degree than the degree of A.B. as an introduction to the study of medicine.

It is to me a matter of deep regret that the druggist feels that he is being sidetracked by the physician and veterinarian, but, speaking for myself, I assure you that I prefer to prescribe whenever possible, if for no other than financial reasons. Most of the drugs I furnish must be charged to profit and loss, as I rarely get direct pay for them, and no doubt most of my veterinary *confrères* are in like fix. However, it is rarely possible to prescribe in country practice, and, while I realize that my patients might fare a little better if I could sit down and prescribe such remedies as seem best suited to the case in hand, circumstances forbid.

There is, however, no reason why a local druggist cannot supply most of the drugs used by physicians or veterinarians if he is satisfied with the differential discount, and if he is not content with his share, he is not entitled to kick. If I come into your store offering cash or good credit, and you decline to meet my reasonable price requirements, you should not take it ill if I take care of myself. Neither my diploma nor your diploma conveys any profit privileges.

We must meet the conditions of our day successfully or be sidetracked. If I cannot render my services at a reasonable rate and in a satisfactory manner, some one else will do so, and if you think that the profit you can get through dealing with me is insufficient, let it go.

Neither of us is entitled to howl under the conditions outlined, and if either of us takes for our motto the quotation from Carlyle: "What is my share of the Universal Swine Trough? Whatever I can get without being transported or sent to the hulks." "What

is porcine bliss? Attainability of hog wash"; if we pollute our several professions for the sake of gain, we are in court with unclean hands; not doing equity, we cannot ask it. If we want to play the charlatan we must take his wage.

A druggist pleading against cut rates on Jones's Sure Cure for Consumption, or a veterinarian pleading for state protection when he is making fake tuberculin tests, is not a subject for sympathy, but rather for contempt. However, I am assured that most of us want to help the world along; that we desire to leave our profession better for our precept, life, and example.

I am an old-fashioned man, and sometimes I find myself thinking that some of the business efficiency I see advocated in your journals could be very well replaced by a greater devotion to your profession, and I take this view because my own life has demonstrated to me that most of us in the long run get our deserts.

"Let not your hearts be troubled." The Nurnberg druggists were asking for protection in the fifteenth century, the English in the seventeenth, and the Americans have carried on the cry to the twentieth.

Charles the Second of England apologized to the courtiers round his bed for being so long a-dying, and surely poor old pharmacy should make a similar apology to you, who are, so far as I can see, very much alive.

Place Charles Kingsley's motto over your desk and try to live up to it. Here it is:

> If I were a cobbler, it should be my aim
> The best of all cobblers to be;
> If I were a tinker, no man in the land
> Should mend a tin kettle like me.

Gentlemen, I wish you a safe delivery from your finals, and a happy issue out of all your youthful tribulations.

March 29, 1915.

AN HISTORIC DRUG STORE.

By J. W. England.

On behalf of Edmund A. Crenshaw (who received it from the grandchildren of the late Daniel B. Smith), I wish to present to the Philadelphia College of Pharmacy a photograph of a drug store which, in its day, was one of the most noted of the country. Founded

by Daniel B. Smith, it was conducted, later, by Smith & Hodgson, and, still later, by Bullock & Crenshaw.

Daniel B. Smith was born in Philadelphia in 1792, and in 1819 opened a drug store on his individual account at the northeast corner of Sixth and Arch Streets. In 1828, William Hodgson, Jr., became associated with him in the business, under the firm name of Smith & Hodgson.

Daniel B. Smith was not only famous as a pharmacist but also as a leading citizen of Philadelphia. He was the first secretary of the College of Apothecaries of 1821, which became, in 1822, the Philadelphia College of Pharmacy. He was the first chairman of the Committee on Publication of the AMERICAN JOURNAL OF PHARMACY, and served the College most efficiently for many years in various official capacities. He was president of the College for twenty-five years (1829–54).

William Hodgson, Jr., of the firm of Smith & Hodgson, was a most accomplished druggist. He received his pharmaceutical education in the store of John Bell & Co., of London, one of the most celebrated establishments of that metropolis. He was an excellent chemist and a skilled manipulator.

The store of Smith & Hodgson at this period was the only place in Philadelphia where chemicals and chemical apparatus especially adapted for schools and laboratories could be obtained, the articles being mostly imported direct from Europe, some few of the chemicals being made in their own laboratory.

In 1844 Charles Bullock became an apprentice of Smith & Hodgson, and in 1847 graduated from the Philadelphia College of Pharmacy. He served the College for many years as trustee, secretary, vice-president, and president. Later, Edmund A. Crenshaw, who was also a graduate of the College, was engaged with the same firm, and in 1849 these two succeeded to the business of Smith & Hodgson.

The attention given to chemistry in its application to the arts increased so rapidly with the development of the mining and manufacturing industries of the country that the new firm found that this branch of the business required special attention. Charles Bullock visited Europe in 1851, obtained much valuable information, and formed important foreign business connections in England and on the Continent, and the firm soon became famous for its large and valuable stock of imported chemicals and chemical apparatus. In

1868, the firm, finding that more room was necessary, moved to 528 Arch Street, where the business was conducted until its dissolution after the demise of the partners. Mr. Crenshaw died in 1894 and Mr. Bullock in 1900.

It is interesting to add that Thomas H. Powers was a one-time apprentice of Smith & Hodgson, leaving them to become associated with William Weightman in the firm of Powers & Weightman, the world-famous firm of manufacturing chemists, at Ninth and Parrish Streets, Philadelphia.

ON THE DETERMINATION OF SMALL QUANTITIES OF HYDROCYANIC ACID.[1]

By Arno Viehoever and Carl O. Johns.

In our work on cyanogenetic plants we found it necessary to estimate small quantities of hydrocyanic acid. The various titration methods as well as the silver gravimetric methods had to be excluded because we were working with plant distillates which usually contain reducing compounds. Furthermore, the quantities to be determined were often too small to permit the use of the above methods. We frequently had to deal with less than 0.5 mg. of hydrocyanic acid. Chapman [2] has shown that the picric acid colorimetric method of Waller [3] is not applicable to plant distillates which usually contain reducing substances other than hydrocyanic acid. This left two colorimetric methods to be examined, namely, the thiocyanate method and the Prussian blue method.

In the thiocyanate method of Francis and Connell [4] the hydrocyanic acid is distilled into a solution of potassium hydroxide, yellow ammonium sulphide is added, and the solution is evaporated to dryness. The residue is dissolved in water, acidified with hydrochloric acid, and the mixture is filtered to remove sulphur, after which the filtrate is further acidified and boiled to cause precipitation of the free sulphur. The process of boiling and filtering is repeated

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[1] Reprinted from the *Journal of the American Chemical Society*, vol. xxxvii, No. 3, March, 1915.

[2] *The Analyst*, **35**, 471 (1910); **36**, 269 (1911).

[3] *Proc. Royal Soc.* (B), **82**, 574, 1910; *The Analyst*, **35**, 406 (1910).

[4] *Journal of the American Chemical Society*, **35**, 1624 (1913).

until all of the sulphur has been removed from the filtrate. Ferric chloride is then added to the filtrate and the color of ferric thiocyanate is obtained. After an examination of this method we found that it was not accurate enough for our work. Our two chief objections to this method are as follows:

In boiling an acid solution of a thiocyanate, some free thiocyanic acid is lost because it is volatile, the boiling-point of the acid being 85°. This loss was shown by taking two equal quantities of potassium thiocyanate, diluting both portions with water, acidifying with hydrochloric acid, and boiling one of them for ten minutes in an Erlenmeyer flask. The boiled solution was then cooled. Both the boiled and unboiled portions were tested by adding equal quantities of ferric chloride. The portion that had been boiled gave less color than the one not boiled. This test was repeated and we found that in every case boiling resulted in a loss of thiocyanic acid.

The second important objection to the thiocyanate method is based on the nature of the reaction between a thiocyanate and ferric chloride, $FeCl_3 + 3KCNS \rightleftarrows Fe(CNS)_3 + 3KCl$. The equilibrium of this reaction is so easily disturbed by the addition of ferric chloride, intensifying the color, or the addition of other salts, diminishing this color, that it is difficult to adjust conditions so as to obtain constant results. Changes of temperature also have a marked influence on the density of the color.

In recent years several papers have been published on the formation of Prussian blue from cyanides and the colorimetric estimation of the cyanide by comparison with a standard suspension of Prussian blue. The most careful attempts to arrive at a quantitative method seem to have been made by Berl and Delpy and by Lander and Walden.

Berl and Delpy[5] make the solution to be tested alkaline with potassium hydroxide, add a solution of ferrous sulphate, allow the mixture to stand at room temperature for at least ten minutes, shaking frequently, and finally boil for two to fifteen minutes. The resulting mixture is cooled and then acidified with hydrochloric acid. In the case of very dilute solutions of hydrocyanic acid, Berl and Delpy shake out the acidified solution with ether eight to ten times,

[5] *Ber.*, 43, 1430 (1910).

and shake out the ether with a small quantity of potassium hydroxide solution, thus obtaining the hydrocyanic acid in a more concentrated form.

The method of Berl and Delpy has been improved by Lander and Walden.[6] These workers concentrate dilute alkaline solutions of hydrocyanic acid by boiling, the final concentrating being carried out in a test-tube almost to dryness. The small quantity of liquid left is then cooled and ferrous sulphate solution added. The mixture is allowed to stand ten minutes, with frequent shaking, then acidified with hydrochloric acid and warmed gently.

Vorländer[7] investigated the formation of Prussian blue from cyanides. He adds a solution of ferrous sulphate to the alkaline solution of the cyanide and boils for one to two minutes. He then filters and acidifies the filtrate with hydrochloric acid, after which he adds a cold, freshly-prepared, saturated solution of ferrous sulphate. He allows the mixture to stand until the maximum color is obtained.

Knight[8] adds to the alkaline distillate containing hydrocyanic acid, solid ferrous sulphate, then a solution of ferric chloride, and boils for one minute. Hydrochloric acid in excess is then added to the hot solution. The precipitate of Prussian blue is filtered, washed with alcohol, and dissolved in a sufficient quantity of sodium hydroxide solution. This solution is acidified with acetic and hydrochloric acids, ferric chloride is then added, and any brown color is removed by adding more hydrochloric acid. The mixture is concentrated to about one-half the original volume and the precipitate of Prussian blue, after filtration, is determined by weighing.

In a method involving the quantitative estimation of a substance by means of colorimetry, it is obvious that a given quantity of the substance should always produce a given density of color in a given volume of solution. It is also necessary that the shade of color should always be the same. For instance, a blue solution cannot be compared accurately with a blue-green solution. Our aim in this work has been to obtain a constant shade as well as density of color. We have studied the following conditions which influence the formation of Prussian blue and the shade of the suspension.

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[6] *The Analyst*, **36**, 266 (1911).
[7] *Ber.*, **46**, 181 (1913).
[8] *J. Ind. Eng. Chem.*, **6**, 909 (1914).

Influence of Concentration on the Formation of Prussian Blue.

Berl and Delpy found that they obtained less Prussian blue from given quantities of hydrocyanic acid in a dilute than in a concentrated solution. These authors, therefore, concentrated dilute solutions of hydrocyanic acid by shaking out with ether as previously mentioned. They state that in this manner nearly all of the hydrocyanic acid can be obtained. In our attempts to concentrate the hydrocyanic acid by means of ether, we found that we could not obtain nearly quantitative results. These low results are due partly to the loss of hydrocyanic acid which will occur by evaporation of the ether. This evaporation cannot be prevented at room temperature, since the acid solution has to be shaken out eight to ten times with ether. Moreover, the volume of alkali needed to extract the hydrocyanic acid from the ether will be so great that the maximum quantity of Prussian blue can scarcely be expected, as shown below.

Lander and Walden, finding also less precipitate of Prussian blue in dilute than in concentrated solutions of hydrocyanic acid, boiled the alkaline solution down almost to dryness. They state that this could be done without the loss of hydrocyanic acid.

The influence of concentration is indeed a very important factor. We made a series of experiments, using 1 mg. of potassium cyanide in each case and concentrations ranging from less than 1 Cc. to 10 Cc. In a dilution of 10 Cc. less than one-half as much Prussian blue was obtained as when the volume was only 1 Cc. We found that the maximum color was obtained only when the volume of solution to be tested was not greater than 1.5 Cc., while in greater volumes the density of the color decreased with the increasing volume. Where the quantity of potassium cyanide was more than 1 mg. the volume of the solution to be tested could be somewhat increased without loss.

Hence, working with the methods of Berl and Delpy or Knight, where larger volumes than those mentioned above are used, the maximum quantity of Prussian blue would not be obtained.

To test the method of concentrating used by Lander and Walden, we evaporated 25 Cc. of an alkaline solution of a cyanide to 1 Cc. in a distilling flask and lost almost one-third of the cyanide. When the final evaporation was performed in a test-tube the loss was less, but still considerable. Hence it appears that the method of Lander and Walden also cannot give the maximum quantity of Prussian blue,

since these authors evaporate over a free flame. It may be mentioned in this connection that evaporation in an open dish on a steam bath resulted in still greater losses than those mentioned above.

After numerous failures we found that alkaline solutions of hydrocyanic acid can be concentrated without appreciable loss by distilling under diminished pressure, as described below.

Influence of Salts on the Formation and Precipitation of Prussian Blue.

Vorländer states that the presence of salts delays or prevents the formation of Prussian blue. We tried the addition of salts, because in our early experiments we often obtained what seemed to be a colloidal form of Prussian blue. Since salts are known to precipitate colloids we tried the effect of adding sodium chloride and found that a clearer blue color was obtained than without the addition of this salt. We also tried the effect of several other halogen salts. Finally, we found that the presence of potassium fluoride had a remarkable effect on the formation and color of the Prussian blue. On acidifying in the final stage of the test the color appears at once and is very brilliant. The absence of a green shade makes it particularly suitable for comparison with a standard. If the acid is added very gradually the iron hydroxides dissolve and a colorless liquid with a white precipitate is obtained. On the addition of more acid the blue color appears. This is explained by the fact that ferric salts produce a complex salt with potassium fluoride,[9] K_3FeF_6. When an excess of acid is added this complex salt is decomposed and the ferric ions needed for the formation of Prussian blue are furnished. Contrary to the statement of Vorländer, our experiments show that certain salts, such as sodium chloride and particularly potassium fluoride, hasten the formation of Prussian blue.

Influence of Acids on the Formation of Prussian Blue and on the Color of the Suspension.

Previous workers all seem to have used hydrochloric acid in the final stage of the test for a cyanide to precipitate the Prussian blue. We found that an excess of this acid tends to make the color of the suspension green, owing to the formation of ferric chloride. The mixture of the yellow ferric chloride solution with the Prussian

[9] Greef, *Ber.*, **46**, 2511 (1913).

blue produces the green shade. To avoid the formation of the green shade we tried the effect of acids other than hydrochloric acid. We obtained good results with sulphuric and nitric acids in different concentrations. Hence these acids are recommended instead of hydrochloric acid.

Vorländer and Knight both filter off the iron hydroxides from the alkaline solution of sodium ferrocyanide and then acidify *before* adding the iron salt. This procedure may lead to a loss of hydrocyanic acid, since ferrocyanic acid oxidizes rapidly according to the following equation:

$$7H_4Fe(CN)_6 + O_2 = 24HCN + Fe_4[Fe(CN)_6]_3 + 2H_2O$$

Influence of Ferric Iron on the Formation of Prussian Blue and on the Color of the Suspension.

It is to be noticed that Berl and Delpy, Lander and Walden, as well as Vorländer, used only ferrous sulphate for the formation of small quantities of Prussian blue. In the ordinary laboratory test for a cyanide, ferric chloride is also added, which changes the color to a greenish shade and makes accurate colorimetric determinations impossible. The addition of a ferric salt is not necessary, since enough of the ferrous salt is oxidized during the operation to furnish the ferric ions needed. According to our experience it is very important that there should not be a large excess of ferric salts present. Therefore, to prevent the oxidation of too much of the ferrous hydroxide to ferric, we remove most of the air from the solutions of the cyanide by means of a water vacuum pump.

In this connection we may quote Vorländer's statement.[10]

"Die Meinung ist verbreitet, dass zum Zustandekommen des Berlinerblaus aus Ferrocyankalium die Gegenwart von Ferro- und Ferrisalz nützlich sei. Ich habe hierfür nicht das geringste Zeichen finden können."

Here one might obtain the misleading impression that Prussian blue is formed in the utter absence of a ferric salt. Vorländer probably means to say that the addition of ferric salt is unnecessary, as enough of the ferrous salt is oxidized by the action of atmospheric oxygen to furnish the ferric ions needed.

Influence of Heat on the Formation of Prussian Blue.

It is interesting to note that other workers apply heat in the test for a cyanide. Sometimes the alkaline mixture is heated, and

[10] *Ber.*, **46**, 188 (1913).

sometimes heat is applied after adding the acid. Others recommended that the mixture be heated, both before and after the addition of acid. In testing by our method heat is not necessary if potassium fluoride is used. In using sodium chloride instead of potassium fluoride, or in the absence of these salts, gentle heat hastens the formation of Prussian blue.

Description of the Method.

As a result of our various experiments, we recommend the following procedure: Before concentrating the hydrocyanic acid solution, as in the case of a distillate, the portion to be tested should contain a slight excess of free sodium hydroxide. We used 0.02 to 0.1 g. This solution is then concentrated in a round bottom flask of 200 Cc. capacity by using a vacuum pump and condenser. The heat is supplied by immersing the flask in a water-bath kept below 70°. To avoid any loss by spattering, the flask is fitted to the condenser by means of an adapter such as is used in the Kjeldahl method for the determination of nitrogen. We concentrate until less than 1 Cc. of liquid remains in the flask. Two-tenths to one-half cubic centimetre of 3 per cent. freshly-prepared ferrous sulphate solution and about 0.05 g. of potassium fluoride are then added. The flask is exhausted at once by means of a water vacuum pump. The contents are mixed by rotating the flask. After five to ten minutes the flask is detached from the pump and the mixture acidified with 30 per cent. nitric acid. The blue color appears at once. Where only traces of hydrocyanic acid are present it is sometimes necessary to warm to about 50° in a water-bath before the color appears. The suspension is then diluted to a volume that would give a color density convenient to compare with a suspension of Prussian blue made from a known weight of potassium cyanide. As a standard we used a suspension of Prussian blue made from 1 mg. of potassium cyanide. Such a suspension diluted to 25 Cc. gave a color of convenient density. For comparison we used a Duboscq colorimeter.

If the cyanide solution to be tested was sufficiently concentrated so that further evaporation was unnecessary, the test could be made in a test-tube. We kept the air out by means of a stopper and rotated the tube only enough to mix the reagents, allowing the mixture to stand five to ten minutes before acidifying. Much shaking must be avoided to prevent excessive oxidation of the ferrous hydroxide.

We ascertained the accuracy of our method by diluting 1 Cc. of a standard solution of potassium cyanide to 25 Cc. and evaporating under the diminished pressure to 1 Cc. When the residue was tested as described above we obtained the same quantity of Prussian blue as that formed by applying the test to 1 Cc. of the undiluted standard solution.

The quantities of reagents mentioned are suitable for 1 to 2 mg. of potassium cyanide. If less than 1 mg. of potassium cyanide is present, the quantities of the reagents should be reduced accordingly. A large excess of reagents must be avoided in order to obtain the maximum density of color. When the analysis is carried out as described the maximum error should not exceed more than 1 part in 20. Thus in a plant giving 20 mg. of potassium cyanide per 100 g. of plant the results might vary by 0.001 per cent. if 100 g. of material are used for analysis.

Application as a Qualitative Test.

This method also proved to be a very delicate qualitative test for the presence of a cyanide. Owing to the possibility of obtaining a pure blue color we were able to detect with certainty 0.00002 g. of potassium cyanide, which represents less than 0.00001 g. of hydrocyanic acid.

Application to Microchemical Analysis.

The test for hydrocyanic acid was applied microchemically to sections of cherry bark and bitter almond with marked success. Sections or small parts of the material were treated with the reagents in a test-tube according to our method.[11]

Conclusions.

1. Dilute alkaline solutions of a cyanide can be concentrated under diminished pressure without appreciable loss of cyanide.

2. The maximum quantity of Prussian blue can be obtained from a cyanide only when the volume of the solution to be tested is sufficiently small, as has been indicated by Berl and Delpy and by Lander and Walden.

3. In the test for a cyanide it is better to acidify with nitric

[11] Further work is in progress on the application of this method to microchemical analysis.

or sulphuric acid than with hydrochloric, since an excess of the latter tends to produce a green color.

4. Any considerable excess of ferric salts should be avoided in testing for a cyanide.

5. Application of heat is not necessary in testing for a cyanide by the method described.

6. The presence of certain salts, particularly potassium ~~chloride~~ FLUORIDE, in the liquid to be tested, has proved to be of great advantage.

7. The method furnishes a very delicate qualitative test for the presence of a cyanide.

8. The method is suitable for the estimation of very small quantities of a cyanide in distillates.

9. The test as described herein can be applied microchemically to sections of cyanogenetic plants.

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COMMERCIAL GLUCOSE AND ITS USES.[1]

By GEORGE W. ROLFE.

A MUCH MISUNDERSTOOD AND MALIGNED PRODUCT—NECESSARY FOR CERTAIN FOOD STAPLES AND A GOOD SUBSTITUTE FOR MORE EXPENSIVE INGREDIENTS.

Most well-informed people know that in the early part of the last century Kirchoff was the first to describe a sugar made by boiling starch with dilute sulphuric acid, and that this sweet, subsequently found to be other than cane-sugar, was called "glucose" or "grape-sugar." Later it was termed "dextrose" when in the progress of science it became necessary to distinguish the individual from a whole family of "glucoses" which had been discovered.

Nowadays, most of us have heard of "glucose" as a commercial product of doubtful reputation. People look askance when glucose is mentioned. Confectioners and grocers make haste to deny that glucose ever appears in their products. Glucose is classed with harmful food adulterants, and has been called by pure food experts the "champion adulterant" of all. It has been depicted in cartoons as a devil with hoofs and horns. Glucose has also been called "mu-

[1] Reprinted from *Science Conspectus*, vol. 5, No. 1.

cilage," the implication being that it is only fit for postage-stamps and not for human stomachs. This may be why many associate glucose with glue. The names sound alike and both are sticky, but the reasoning is like assuming that all gentlemen are gentiles. Glucose makes a rather poor adhesive, but one who is hard put for mucilage might so use it with indifferent success just as it is possible to use tapioca pudding, molasses or other sticky foods.

Turning to the advertising literature of the glucose manufacturers, we note that many eminent authorities laud glucose as most wholesome, that it is the principal sweet of fruits and one of the intermediate products of the digestion of starch in the human organism, is found in the blood—and similar statements, all of which, like the damning ones of some pure food experts, are " important if true."

Notwithstanding that annually between thirty and forty million bushels of Indian corn are made into glucose, comparatively few except those engaged in the numerous industries in which glucose enters ever see the product. The idea of the general public, professional as well as the laity, seems to be that glucose is mostly composed of grape-sugar, which is made according to the Kirchoff method by boiling starch and oil of vitriol and neutralizing the mixture with chalk. Many supposedly up-to-date cyclopædias make such statements.

Much of the ignorance concerning this important food product is due to the following facts: Pure commercial glucose is practically unknown in household cookery, and so is not sold in a package convenient for household use. While it is in multifarious food products found on the grocers' shelves, it is rarely seen there in its original state. This is equally true of raw sugar. Years ago, raw open-kettle sugars were familiar to all New England housewives and were used by them in cooking. Raw sugars made by modern processes are used to some extent now in England and European countries, but nowadays few of the citizens of this country, outside of the sugar producing districts, ever see raw sugars, which are sent directly to the refineries in packages weighing several hundred pounds each and in a condition not fit for domestic use. Glucose, like refined sugar, is manufactured in comparatively few factories, and these of large capacity, for the manufacture of glucose requires a large outlay of capital and consequently large output. The cheapness of the product makes its manufacture profitable only on a large scale. This is equally true of sugar.

What is commercial glucose? In general appearance it is a transparent, very viscous syrup, often practically colorless, but usually of a light straw color, sweet, but with little if any other flavor. For this reason, glucose, like sugar, has been termed a "neutral sweet" —not neutral in the chemical sense—although such products are always chemically neutral within practical limits of testing—but so called because when pure they have no characteristic flavor other than sweet and will take any added flavor unchanged.

Glucose is not made by use of oil of vitriol and chalk, nor is glucose, in the ordinarily accepted sense of dextrose, its characteristic ingredient. The trade name "glucose," while well established by custom of years, is no more suited to the present product than is "chloride of lime" to bleaching powder or "hyposulphite of soda" to the commercial salt sold under that name. It is true that the basic process by which glucose is made from starch is on the lines of Kirchoff's original experiments, but the methods are quite different. The "starch milk," a suspension of the granules in water, is pumped into large pressure boilers of gun metal, and is cooked for about ten minutes with a few tenths of a per cent. of hydrochloric acid (commercial muriatic acid) under a pressure of about 50 pounds of steam. The starch is not treated long enough by this process to convert it entirely into grape-sugar (true glucose), only about 20 per cent. being produced. There is, in fact, less of the glucose sugars, properly so called, in commercial glucose than occur as natural ingredients of cane-sugar molasses, and far less than in honey, which is composed almost entirely of glucose sugars, nearly half of which is dextrose (grape-sugar), this being the sugar which separates out when the honey granulates.

Commercial glucose as now made contains less than 20 per cent. of true glucose sugars, the rest being a mixture of malt-sugar (maltose) and dextrins, more or less in chemical combination in the approximate proportion of nine parts of maltose to seven of dextrin. In percentages of total sugars and dextrins, there are, in round numbers: maltose, 45 per cent., dextrose, 20 per cent., dextrin, 35 per cent., the proportions varying somewhat in different lots.

These three carbohydrates, *dextrose,* which is a true glucose sugar, *maltose,* belonging to the cane-sugar family, and making up nearly half of the total, and *dextrin,* a gummy ("colloidal") substance closely related to starch paste, compose over 99 per cent. of the solid matter of refined commercial glucose. This composition

has been found to be the most desirable for imparting to the product the properties most suited for a syrup which can be refined readily, and at the same time contain enough colloidal material to prevent its crystallizing at any concentration. This colloidal matter also renders the syrup capable of dissolving considerable amounts of cane-sugar without crystallization. Such a product is peculiarly valuable in the preparation of syrups, candies, preserves, and jellies, quite apart from its use as a sweet. It also contains nearly the maximum amount of malt sugar that can be produced by such a process.

The rest of the dissolved substance of commercial glucose consists of 0.3 to 0.5 per cent. of mineral matter, mostly composed of sodium chloride from the neutralization with soda of the hydrochloric acid used in the manufacture, sulphites which are added at various stages, phosphates and other salts from the natural mineral matters present in minute quantities in the starch or coming in part from the bone-black used in the refining process. There is also about 0.08 per cent. of nitrogen, corresponding to five or six times its weight of organic substances from the gluten left in the starch. Much of this nitrogenous matter is not gluten, but simpler organic compounds resulting from the action of the acid (used to convert the starch) on the gluten. These nitrogenous matters have much to do with the quality of the glucose, and it is on this account that they are of peculiar importance, although present in minute amounts. The impurities from the gluten which are less acted upon by the acid, the "albumoses," give trouble to the candy manufacturer by causing foaming in his kettles, while this property is the joy of the brewer. Those gluten substances which are changed further by the acid, the "amino bodies," tend to make the glucose darker and also impart a flavor which, though barely perceptible, is disagreeable—bitter or fishy. Manufacturers used to correct the objectionable effects of these impurities by the addition of sulphites to the glucose, but this was but a temporary expedient and undesirable in a food product. Glucose has been much improved in recent years by practically eliminating the effect of these impurities by more efficient purification of the starch used in its manufacture.

The glucose process does not end with the acid treatment of the starch and the neutralizing, as at this stage the dilute syrup is far from pure, containing oily matters from the corn, some undecomposed gluten and other impurities, mostly in suspension. This

liquor before it is concentrated to a syrup of about 80 per cent. solids undergoes a refining with bone-black closely resembling that of cane-sugar, the apparatus being practically identical—filtering through bags and bone-black filters—but in the case of glucose all impurities affecting the quality of the syrup have to be removed or destroyed, as there is no purification by crystallization.

Hence glucose, like granulated sugar, is one of the purest food products in use, however pernicious the properties that may be ascribed to it.

Space does not allow a detailed description of glucose manufacture, which is of great interest, owing to the numerous by-products which are made, and also because, while glucose is the chief in output, its manufacture is only one of many starch products carried on at the same time.

The following table, taken from an advertising circular of a manufacturer, shows in a concise way how the different parts of the corn kernel are utilized:

Parts of corn kernel	*Composition*	*Products*
1—Germ	Oil and oil-cake	Corn oil, corn oil-cake, corn oil meal.
2—Endosperm (body of the corn)	Starch	Dry starches, dextrins, and, by conversion, corn syrups [glucose] and sugars.
	Gluten	Gluten feed.
3—Hull	Bran	Gluten feed.
4—Water added for steeping	Soluble substances of corn	Gluten feed.

The oil is used principally for soap and for making vulcanized products used for rubber substitute. The oil-cake and meal from the cake are used as cattle feed. The gluten and bran from the starch, mixed with the soluble matters extracted by the water used to soften ("steep") the grain before grinding, is made into "gluten feed," also for cattle. All these are valuable by-products for which there is a good market. The starch in a moist state, known as "mill starch," is the raw material for making the various goods which are sold under the names of "glucose" ("corn syrup"): "corn-sugar" ("grape-sugar"), the latter a hard product which is largely composed of dextrose, but never known in trade as "commercial glucose" and little used as a food product; "dextrins," true adhesives which are usually made by roasting starch and entirely different in characteristics from the dextrin ingredient of commercial

glucose; besides numerous " dry starches " used by laundries, confectioners, and in many other industries, as well as for household purposes.

At present prices, commercial glucose, a syrup containing about 80 per cent. of the pure carbohydrates in solution, sells at about 2¼ cents per pound (26 to 28 cents per gallon), or at about 2.7 cents per pound of actual dissolved substance. Is its sole use that of an adulterant of better food materials, as some food reformers claim? Is glucose used to adulterate our ordinary grocery sugars?

It is well known in the history of the industry that some thirty years ago a Chicago concern spent some millions of dollars and much valuable time in trying to adulterate fine-grained white sugars with solid grape-sugar of high quality, made from starch, but the attempt failed miserably, simply because the stuff would not stay mixed and the grains " set " in a solid mass after a short time. In years gone by, glucose was also much used to mix with cheap, poor-grade molasses, making a brighter, more attractive product which, so improved, could be sold at the price of higher grade molasses. This form of adulteration is so easily detected that it is rarely resorted to in these days of pure food legislation. The last case which came to the writer's notice was one of a New York molasses dealer who was heavily fined for having a few per cent. of commercial glucose in his molasses, although his defence was a plausible one—that the glucose was some accidentally left in the barrel, old glucose barrels being much used for tropical molasses shipments.

Glucose is now used in a legitimate manner to mix with cane-sugar syrup in the proportion of 85 per cent. of glucose to 15 per cent. of syrup, a little salt and sometimes vanillin being added to improve the flavor. The cane-sugar syrup is usually refinery molasses (" barrel syrup "), which imparts the principal flavor. These mixed syrups are sold openly as glucose or " corn syrups," and as their flavor is superior to the original molasses there seems to be no reason why they are not wholesome food products for legitimate trade, even though some people there are who prefer the flavor of the syrups made from the natural cane juices and are willing to pay the higher price for such. Certainly, such glucose syrups are preferable to the average grocery molasses, either from the standpoint of the epicure or the sanitarian.

Commercial glucose is used in large quantities in the manufacture of cheap jams and preserves. Apple cores and skins from fruit

in its preparation for evaporation or preserving are the basis for most cheap jellies; the pectin substance and juice being extracted by the usual processes of jelly making and mixed with glucose and sugar forms a jelly material to which other fruit juices are added. The law requires such jellies to be plainly described on the label so that the consumer is informed that he is using a jelly made of apple and glucose with a fruit flavoring, and is at perfect liberty to buy the pure, glucose-free fruit product if he so prefers. What interests the public is: Are these cheap jellies unwholesome, or is there other reason why the man with the slim pocketbook should not buy them? This question is quite apart from whether they contain glucose or not, but deals with the soundness and wholesomeness of the ingredients used and the cleanliness of their preparation.

By far the largest amount of glucose is consumed in the manufacture of candy, the peculiar properties of this syrup making it especially valuable in this industry, as has been explained. The requisite for most candy is that it should not "grain" (crystallize), and glucose, owing to its colloidal nature, is the most effective and wholesome substance to prevent this. The popular impression that glucose is used in candy-making because it is a cheap substitute for sugar and that its sole function is to give sweetness is only approximately correct.

How sweet is glucose relative to cane-sugar? Determinations of the sweetness of a saccharine product are very unsatisfactory, owing to personal equation and also to the influence of the other mixed ingredients and even the physical condition of the substance tested.

Granulated sugar tastes sweet. Powder it in a mortar and it will taste less sweet. Owing to this fact it is hard to convince some people that powdered sugar is not adulterated, although this practice, easily detected, is practically unknown at present. A quarter of a grain of quinine mixed into a pound of granulated sugar is said to make it taste sweeter. Common salt in small quantities will improve the sweetness of cake and other sweet foods, as all cooks know. Raw sugars, even when they contain negligible quantities of the sweeter mother-syrups, taste distinctly sweeter than granulated sugar, although their actual sugar content is less. This is due to the salts and extractive matters in the raw product, and it is why many cooks sigh for the old-fashioned, open-kettle sugar, and even prefer the refiners' imitation goods to granulated in making their apple pies.

Relative tests of the sweetness of cane-sugar and glucose (*dex-*

trose) have been made by dilution experiments on the pure sugars, but, so far as the writer knows, no relative tests of the sweetness of commercial glucose as now made have been published. Taking this value to be 0.5 for the solids in glucose, sugar at 5 cents is cheaper as a sweetener than glucose.

As a matter of fact, very little candy is made with glucose as the only sweet. Usually, candy contains 60 per cent. or more of cane-sugar, the sweetening of the glucose being of much less importance than the other properties it imparts to the mixture.

It seems reasonable to infer that commercial glucose, rather than being a serious competitor of cane-sugar, has really increased the consumption of the latter, especially in candies. Because of the great advantages from the use of glucose in candy-making, the industry has had an impetus which has greatly increased sugar consumption.

The relative wholesomeness of candies made from glucose and those made from cane-sugar has never been decided, and may never be. The dextrins of " glucose " as now manufactured are in great part in combination with the malt-sugar and seem in every way identical with the malto-dextrins obtained by the action of malt on starch, and are digested more in the intestines than in the stomach as compared with pure sugar candies. Whether this is an advantage or not, the physiologists must decide.

Glucose is extensively used in industries not making food products. It is used in cheap soaps, for " filling " leather and tanning extracts, and, as many of its uses in such industries are apparently for adulteration, such practices have no doubt added to its reputation as the " champion adulterant." As was pointed out in an article in a previous number of this magazine,[2] on the industrial uses of sugar, the highly respectable beet-sugar of 99 per cent. purity is used in Europe for precisely the same purposes, the choice between sugar and glucose as a " filler " being merely a matter of price. Cane-sugar has also been used extensively to " fill " coal-tar dyes and adulterate chocolate without having its respectability seriously impugned.

In view of the undoubted commercial importance of glucose as a food product it would seem as if its value in dietetics and food economics, as well as its relative wholesomeness, ought to be studied in the light of a proper knowledge of its special characteristics. To

[2] *Science Conspectus*, No. 2, 1913.

call glucose "mucilage," or to ascribe to it properties of a dextrose solution, is either ignorant or dishonest. So far as the use of glucose as an adulterant is concerned, it is the function of the pure food laws to protect the public from these practices, and such obviously are quite apart from the legitimate and open use of glucose, sugar, or any other cheap and wholesome food product as a satisfactory substitute for more expensive ingredients, and the propriety of such a substitute always will be its suitability for the purpose and its cost.

If legislation is appropriate for forbidding the extravagant claims of manufacturers and dealers as to the superiority of their food products, why not legislation to prevent irresponsible statements of "pure food" authorities which are condemnatory? Certainly, the one is as important for the public interest as the other.

THE EFFECT OF CERTAIN CONDITIONS UPON THE ACIDITY OF TOMATO FRUITS.*

By B. M. Duggar and M. C. Merrill.

In a recent communication the senior author[4] has referred to the possibility that the total acid content of tomato fruits ripened at a temperature of 30° C., or above, may be related in some way to the failure of lycopersicin development at that temperature. It was determined that the "total acidity for green, ripening, and ripe fruits, grown under the same conditions, is unexpectedly uniform, amounting to 0.57 to 0.58 per cent. citric acid." The fruits just referred to were of the same variety picked at the same time. The tests of acid content of incubated fruits were made later in the season, and these indicated a lower acidity than that of normally green or ripe fruits. At that time the requisite material was obtained from the Department of Horticulture, Cornell University.

During the past summer several varieties of tomatoes were grown in the Missouri Botanical Garden in order to furnish material for further pigment studies, and incidentally this material has enabled us to determine with greater care the acid content of tomato fruits, especially of different varieties, and likewise the comparative acidity of fruits direct from the field and of those of the same picking incubated for various intervals. The tests included below were made by pulping thoroughly a weighed quantity of the tissue (15 Gms.), diluting

* Reprinted from *Annals of the Missouri Botanical Garden*, May, 1914.

with 150 Cc. distilled water, employing for each titration 25 Cc. of this solution diluted with distilled water to 50 Cc., and titrating with n/10 NaOH, using phenolphthalein as indicator. Not less than two titrations were made in any case, and these were from one or more samples of tissue. The accompanying table indicates the variety and condition of the fruit, quantities of n/10 NaOH required to neutralize, and the per cent. of acidity in terms of citric acid.

TABLE SHOWING ACID CONTENT OF TOMATO FRUITS

Variety	Condition			Average number of Cc. of n/10 NaOH, to neutralize	Total per cent. of acid as citric
	When picked	Interval or incubation	When titrated *		
Dwarf Stone.....	Ripe	0	Red	1.695	.52
Dwarf Stone.....	Half grown	0	Green	1.82	.56
Dwarf Stone.....	Half grown	Incub. 32° C. 10 days	Artif. yellow	2.135	.66
Dwarf Stone.....	Half grown	Lab. 24 days	Red	1.375	.42
Dwarf Stone.....	Half grown	Incub. 32° C. 10 days	Green	1.485	.46
Sparks's Earliana..	Ripe	0	Red	1.695	.52
Sparks's Earliana..	Half grown	0	Green	1.87	.58
Truckers' Favorite.	Half grown	Incub. 32° C. 22 days	Artif. yellow	2.56	.79
Truckers' Favorite.	Half grown	Lab. 24 days	Red	1.66	.51
Red Peach.....	Half grown	Incub. 32° C. 22 days	Artif. yellow	2.115	.65
Red Peach.....	Half grown	Lab. 24 days	Red	1.675	.52
Yellow Peach.....	Half grown	Incub. 32° C. 22 days	Artif. yellow	2.47	.76
Yellow Peach.....	Half grown	Lab. 24 days	Yellow	2.065	.64
Yellow Plum.....	Ripe	0	Yellow	2.12	.65
Yellow Plum.....	Half grown	0	Green	1.92	.59
Yellow Pear.....	Half grown	Incub. 32° C. 20 days	Artif. yellow	1.60	.49
Yellow Pear.....	Half grown	Lab. 24 days	Yellow	1.395	.43

* All fruits designated "red," "yellow," and "artificial yellow" were, at the same time, ripe.

The results above reported may not yet be as extensive as might be desired in order to follow closely the changes in acidity under different conditions, but they consistently point out certain relations of interest, which may be briefly enumerated as follows: (1) A comparison of the acid content of green and normally ripened fruits was made, using Dwarf Stone, Sparks's Earliana, and Yellow Plum, all direct from the field. There were no marked differences between the green and ripe stages within the variety; yet the acidity of the green fruits of the red varieties in these tests is somewhat higher, while the acid content of the green fruits of the one yellow variety tested is somewhat lower. (2) Fruits of Dwarf Stone, Truckers' Favorite, Red Peach, Yellow Peach, and Yellow Pear which were picked green and ripened in the incubator at 32–33° C. (10–22 days) exhibit a higher acid content than either those ripened on the vines

or those ripened at the temperature of the laboratory. (3) There are considerable differences in the acidity of varieties, but, judging from the results of these tests, the normally ripened fruits of yellow varieties commonly contain as much acid as those of red varieties.

The several facts brought out by these tests render it obvious that there is now not sufficient evidence to justify relating pigmentation to total acidity. The acidity changes are, however, interesting in themselves, in these as well as in other fruits. No attempt was made to follow progressively any changes in acidity induced by conditions; but in titrating on one occasion, after an interval of two days, new samples of both red and yellow fruits which had been ripened in the laboratory, it was found that the acidity had noticeably declined since the previous titrations from the same lots of fruits.

We have reckoned the acidity of the tomato in terms of citric acid, as is customary. It should be noted, however, that, while Bowman[3] and others report citric as the chief acid of the tomato, Albahary,[1] on the contrary, gives 0.48 per cent. as the malic acid content and 0.09 per cent. as that of citric acid in the fresh fruits. The author last mentioned gives no indications respecting the variety or condition of the fruit employed. In a later contribution[2] he reports the results of analyzing tomato fruits in different stages of maturation, as follows: "1° le fruit vert avant l'apparition de la graine dans la pulpe; 2° le fruit vert au moment où la graine est complètement formée; 3° le fruit rouge arrivé à sa pleine maturation." In the second stage, corresponding to practically full-grown, green, he finds 0.58, and in the ripe fruits 0.42 per cent., of organic acids. This is in complete agreement with our findings. In the earliest stage of fruit development Albahary finds an acid content of only 0.116 per cent. Wehmer,[5] after quoting Albahary[1] as to the percentage of the various acids in the fruit, remarks, "Die Acidität wechselt stark je nach dem Reifestadium (von 0.06–0.697 per cent. des Saftes auf Citronensäure berechnet)." He does not indicate the source of these data, and certainly the smaller percentage given can refer only to the youngest stages of fruit development.

Graduate Laboratory, Missouri Botanical Garden.

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[1] Albahary, J. M.: Analyse complète du fruit du Lycopersicum esculentum ou Tomate. Compt. rend. acad. Paris 145: 131–133. 1907.

[2] ————, Etude chimique de la maturation du Lycopersicum esculentum (Tomate). Compt. rend. acad. Paris 147: 146–147. 1908.

[3] Bowman, W.: Tomatoes: chemical examination of fruits. Va. Agr. Exp. Sta. Bul. 9: 16–18. 1891.

[4] Duggar, B. M.: Lycopersicin, the red pigment of the tomato, and the effects of conditions upon its development. Washington Univ. Studies 1: 22–45. 1913.

[5] Wehmer, C.: Die Pflanzenstoffe 685–686. 1911.

MODERN MEDICINE AND ITS SOCIAL RESPONSIBILITIES.[1]

By Frederick R. Green, A.M., M.D.,

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(*Concluded from p. 235.*)

Another error into which we have fallen as a profession is the tendency to regard the medical profession as a divinely authorized class, whose sacred and distinctive function is the protection of the people, either with or without their consent. It is difficult to understand on what rational basis such a belief can rest in a scientific profession like ours. The medical profession is recruited from the same class as that which furnishes the lawyers, judges, ministers, teachers and business men of our country. The men who go into medicine are neither wiser, more unselfish, more upright, nor more infallible in their judgment than those who make up any other class of professional men. Why should we regard ourselves as of superior mould, or why expect our opinions or views to be accepted on any different basis from those of other men of equal intelligence, except in so far as we are able to justify our judgment? Yet too often medical organizations, as well as individual physicians, have taken the position that they were the courts of last resort; that it was their special function to dictate the terms of public health legislation, and that it was the duty of the public to accept their decisions and acquiesce in their judgment. Now the average American, while willing to do anything that he knows to be for his own benefit, is impatient of restriction, and especially of restriction which he cannot understand. He resents paternalism and dictation, and objects to having

[1] Read before the Utah State Medical Association, Salt Lake City, Utah, September 30, 1914, and reprinted from *North West Medicine*, December, 1914, and January, 1915.

any class or sect try to force him to do anything for his own good unless he is convinced that it is necessary and desirable. Even then he wants to be shown that the inconvenience of conforming to the restriction will bring him benefit greater than the inconvenience brought about by not conforming to it. If you have any doubt as to the universality of this feeling, or think that it is held only by laymen, wait until some bill is introduced into your legislature that imposes some kind of restrictions on physicians themselves and then notice the result. You will generally hear a roar of protest that can be heard throughout the State. Yet the average layman has just as much objection to being regulated as the physician has. The general conclusions to be drawn from this situation are that all proposed public health legislation should be plainly necessary and justifiable; that interference with personal liberty should be the least possible amount necessary to produce the desired result, and that in every case where such interference is necessary it should be done in the least disagreeable way possible, and the reasons for the necessary restrictions should be carefully and clearly explained to the public before their enactment in the form of legislation is sought. Any subject which cannot be explained to the satisfaction of the average citizen had generally best be left out of legislative plans. Science is simply systematized knowledge. If we know a thing we can convince any reasonable person of the truth of our proposition.

The use of so-called "practical political methods" to secure the passage of public health measures has already been mentioned. The last twenty-five years has been a period of special privileges and of many legislative abuses. Instead of legislation being determined by considerations of public interest, it has been too often a matter of barter and sale or of coöperation between representatives of special interests. A legislator representing one interest has voted for measures on condition that the friends of these measures would in turn vote for his measures. Log-rolling, wire-pulling and ring-rule have, at times at least, characterized many of our State legislative bodies. The appeal to physicians, sometimes from our own ranks, has been the enticing one to be "practical politicians and play the game." The statement has been made repeatedly in medical organizations that the only way to secure desired legislation was to follow the tactics used by all so-called "successful" politicians and exercise such influence as could be exerted, regardless of the manner in which it was secured. This argument has been particularly attrac-

tive and seductive because the promoters of public health legislation knew that their plans were for the public good. Too often they have reasoned: "What harm will befall if we do use objectionable methods, so long as the object is the public good and the protection of the people?" The argument that the end justifies the means has too often been used to advance public health legislation. Yet the absurdity of such a method is evident. When measures for the public good are proposed, the people themselves are often indifferent. They do not understand the importance of such legislation. Now instead of making the people understand it so that they will demand and secure sufficient protection for themselves, it is sometimes seriously proposed to secure the passage of a law without attempting to arouse public support, but by the use of political influences. There is undoubtedly a legitimate field for legislation, and even for compulsory legislation, in bringing pressure on the indifferent, ignorant or unruly minority in enforcing police measures which the majority of the people have decided are necessary for the public safety. But the folly of expecting any permanent good to result from the adoption of legislation placing restrictions on the public for its own good when the majority of the public are not only unconvinced of the necessity of such restrictions, but even unaware of their purpose or object, needs only to be stated to be appreciated.

Let it be clearly understood that any criticisms of so-called practical political methods should not be regarded for a moment as questioning the right and the duty of the physician as a citizen to take part in and participate in public matters and legislative bodies to the extent of his ability. The physician to-day, as a rule, is much better qualified than the average citizen to sit as a member of legislative and deliberative bodies. His special knowledge is of particular value to the State or the municipality. His participation in political and legislative affairs along proper lines can result only in good to society. There is a wide field for the physician to occupy as a citizen and a man of affairs, but it does not lie in the realm of machine politics. Neither is there any good reason why the physician as a citizen should not do everything in his power to secure and to support good candidates for any position, legislative or administrative. What I am contending is that political methods cannot be made a substitute for public education on scientific subjects.

Probably the weightiest criticism which can be brought against the medical profession in its public relations during the last forty

years, however, is its failure to adopt any definite, permanent and constructive program in its efforts to secure adequate public health legislation. We have asked the public to accept us as scientific authorities, and we have not been scientific ourselves in handling this problem. There has been little effort made to separate the essential and fundamental from the non-essential and incidental, to secure first the passage of those measures which would lay the foundation for an efficient health organization which is closely related to the rest of the State government, and to develop the powers, functions and activities of such a department. Closely related to this is the occasional advocacy by individuals or organizations of laws on fads or sensational topics. Enthusiastic members of State legislative committees, especially interested in subjects interesting, but of comparatively little relative importance, push their claims for consideration, and these subjects, because they are sensational, are taken up by the newspapers to the exclusion of far more important questions. Abundant illustrations of this tendency can be found in the history of the last forty years. Such legislation is often commendable, if the State and the public are ready for it, and if it does not crowd out more important subjects; but as scientific men we should not allow ourselves to be unduly influenced, either by enthusiasts or by temporary public interest.

If any doubt remains in the minds of any of you as to the difference in point of view of the physician and the layman, it is only necessary to instance the wild and unwarranted charges and loose statements regarding the purposes and aims of our medical organizations that have appeared in the editorial columns of some of our leading newspapers during the last six years. The facts are plain to any one who will go to the trouble to investigate, yet the unfounded and unprovable statements made have seriously reflected on the motives of physicians. The medical profession is not "a medical trust," neither is it a highly-organized, centrally-controlled, powerful organization with sinister plans and motives against the liberties and habits of the public. It is, on the contrary, as every one conversant with the facts knows, a more or less discordant body of 140,000 men of average ability and personal qualities. The principal national organization of physicians, the American Medical Association, is a loose union of fifty-two State and territorial associations, comprising 2000 county societies and approximately 70,000 members, or about one-half of the profession. Careful study of its records and proceed-

ings will show that it is not and never has been dominated either by a single individual or by a group of individuals; that it does not control legislation in the State or the nation, and could not if it would; that it has never had any definite legislative or political policy, either selfish or otherwise, and that it has none to-day; that it has no definite program, and that whatever legislative activities the medical profession, either organized or unorganized, may have undertaken have been largely due to the personal energy of individuals in different States, each of whom has acted on his own initiative, without any common plan of action or any common policy, and certainly without any amount of coöperation worth mentioning. The charges and suspicions of some of those who differ from us are entirely unsupported by the facts, and can be attributed only to ignorance or prejudice. In some ways it would be a most fortunate thing for the public if the American Medical Association were the highly-organized, efficient, nation-wide machine which its critics claim it is, and if we had a definite program which was being steadily and persistently followed. It is highly probable that the very responsibility of such a position would force upon us the adoption of a program which should be broad, charitable, conservative, practical and, above all, permanent. But even if all these things were so, the power of the association could be exercised only as is the influence of any other body of men; namely, through its individual members, so that the influence of the organized medical profession on legislation cannot in the end be anything more than the influence of its individual members as citizens.

What now should be the attitude of physicians, either individually or collectively, toward society and the State? It should be that of a profession, the members of which are drawn from the body of the people, and which partakes in every way of the virtues and weaknesses of the general public, but which, through professional training and experience, possesses technical, scientific knowledge in a certain field, which knowledge, on account of its very nature, is directly inaccessible to the general public, and must, therefore, be translated and presented to them in terms which they can understand. Government by classes is antagonistic to our principles of government. Government by the will of the majority is the only recognized force in this country. Even if it were possible for the entire medical profession to unite in a solid body, to expect or desire that 140,000 men should dictate to and control 100,000,000 people, even within a

limited field, is utterly inconceivable. Still less would it be possible for the 70,000 members of our medical organizations to control 100,000,000 people against their will. Since the relation of physicians to the public cannot be that of dictators or rulers, and since the power for restriction and regulation must always lie in the will of the majority, there remains only a single relation which physicians as a class can maintain toward the general public; namely, that of teachers. It is our function as a profession to take the finding of scientific men the world over, in so far as they are confirmed by wide experience and observation and in so far as they apply to public health conditions, to generalize them and put them in popular language, so that they will be intelligible to the average citizen, and to place these facts before him with a clear statement of what can be done through public coöperation to protect him and his from unnecessary disease. Insistence on the passage of laws for which the public is not yet prepared, or which they do not understand, the use of conventional political methods or personal influence to secure the enactment of laws for which public sentiment is not ready, cannot fail and has not failed in the past to react and to produce, in the long run, more harm than good.

Before discussing the methods by which the education of the public should be carried on, it is interesting to note that the development of our knowledge regarding preventable diseases has unavoidably produced a marked change in the ethical attitude of the physician toward publicity methods. In former generations, as we have seen, the sole duty of the physician was to his patient. As the knowledge which he acquired regarding his patients and their affairs related entirely to the personal interests of the patient, physicians have recognized for centuries the moral obligation to remain silent regarding all professional matters. But to-day, as we have seen, certain diseases are matters not only of personal, but also, to a very large degree, of public concern. On all subjects therefore on which the public may properly look to the medical profession for guidance and advice, it is to-day just as much our duty to speak as it was in former years the duty of our professional forefathers to remain silent.

The proper function of a scientific organization being education, the next question is "Through what channels and by what mediums is such a process of education to be carried on?" All existing agencies and organizations through which public opinion can be

reached and guided should be made a part of such an educational campaign. Newspapers, magazines, books, pamphlets, women's clubs, business men's organizations, universities, colleges, normal schools, public schools, ministers, churches, civic and philanthropic organizations can all be utilized. In planning an educational campaign for a State, it is first advisable to make a general survey of the field and to ascertain exactly what means for education exist, what funds or material are available for the purpose and how the available material can be utilized.

The secret of success is to unite all the available organizations and influences and to avoid the mistake of making such a campaign a medical movement. Physicians should lead, but not monopolize. In such a campaign the press is the most valuable ally. In Utah there are 105 periodicals published, including six daily, three tri-weekly, six semi-weekly and seventy-eight weekly newspapers, three semi-monthly and nine monthly magazines. These are published in fifty-seven towns, of which twenty-three are county seats. The Council on Health and Public Instruction has issued for three years a Press Bulletin, which is sent each week to approximately five thousand newspapers, including six dailies and nineteen weeklies published in Utah. The total cost including postage, printing and all labor for sending fifty-two weekly bulletins to any newspaper in the United States amounts to 80 cents per paper per year. The cost of a bulletin for a single State would probably be a little more, but at an annual expense of $100 or $150 it would be possible to send to every newspaper in Utah a weekly press bulletin containing short, popular articles on health topics suitable for use in the average paper. Members of local societies can secure the coöperation of the editors of local papers, explaining just what is intended and why this matter is being sent out. As a rule, when properly presented, editors are glad to use this material. There has probably never been a time when newspapers were as much interested in public health as to-day. The success or failure of such a bulletin will depend on the ability, tact and good judgment of the man in charge of it. Everything that could possibly be interpreted as for the selfish interest of physicians either as individuals or as a class should be eliminated. All sectarian discussions or bitterness should be omitted. Nothing should appear that is theoretical, indefinite or unproved. Only positively demonstrated facts which have been accepted by the general profession and which are part of our common knowledge should be admitted.

Newspaper bulletins are not the place for the discussion of theories or for the exhibition of hobbies.

Longer articles of an educational nature may be offered to some of the larger newspapers or to the magazines. Short, special articles in the form of pamphlets are often useful, but are, comparatively speaking, expensive, both for preparation and distribution. For the present, it would probably be better for the majority of the State associations to rely on the Bureau of Literature of the Council of the American Medical Association for such pamphlets rather than to attempt to prepare them themselves. The material which we have on hand for distribution is already large and is rapidly growing. Lists and samples of pamphlets on hand can be secured on application.

Women's clubs offer a most promising field for educational coöperation. Composed of the leading and most influential women in each community, they are in many cases really desirous of taking up some definite and practical line of activity. The last directory of women's clubs for the United States shows that there are forty women's clubs in Utah, located in sixteen towns, with a total membership of 1400. Each State federation has a committee on education, a committee on health and a committee on legislation and the interest and coöperation of these organizations can be readily secured on such topics as registration of births and deaths, increase of functions of the State board of health, establishment of county and municipal departments of health, medical inspection of schools and rural school hygiene, conservation of vision, especially among children, and similar topics.

Labor unions are of great value in public health work, provided the matter is placed before them in the proper light. The average labor organization, for instance, is not especially interested in birth registration, because the members do not understand its importance. When they realize that no child labor law is of the slightest value unless it is accompanied by provisions for birth registration, that proper registration of deaths would make it possible to determine the number of fatalities from industrial diseases, mine accidents, etc., and that a laboring man's health is his only capital, he at once becomes interested. The churches and their pastors are, in all cases where health matters are properly presented, among our strongest allies. The success of our plans at St. Paul and Minneapolis last year, and at Philadelphia this year in placing speakers on public health in the pulpits, shows conclusively that our churches to-day

offer a most important educational opportunity. Business men's organizations are also important. In bringing the matter to their attention, it is necessary to emphasize the commercial value of good health both to the individual and the community, and the fact that good health and a low death-rate is a valuable commercial asset for any town. The proper utilization of all of these methods necessarily involves a careful study of the local field. Plans which are effective in one State must be modified in another. No hard-and-fast program can be followed blindly.

Personally, I have long been of the opinion that the most effective method for the improvement of public health conditions which could be adopted would be the organization, in each State, of a public health league, composed not only of physicians, but of men and women interested in improving the health conditions of their town, county and State and working through all of the local organizations in the State. Such a plan is by no means visionary. It has already been put into operation in Minnesota, where the State Association for the Study and Prevention of Tuberculosis and other local special organizations were merged into a general public health league with an executive working in close coöperation with the State board of health, the State medical society, the State university, the general federation of women's clubs, the local business men's organizations and all of the other mediums for reaching and educating the public. Such a combination of the many independent existing organizations can eventually be formed in each State. A lay organization will command the support and arouse the local pride and enthusiasm of the people in a way that no professional organization could hope to do. The organization of these State public health leagues will, I trust, go on until it will be possible to combine them in a national public health league, which will exercise an influence far greater than could be brought to bear by any single profession or class.

If you ask me what are Utah's needs, I must respectfully decline to make a diagnosis or prescribe a remedy. Nothing is farther from my intentions or desires than to pose as a legislative specialist or to attempt to dictate a uniform and stereotyped program for each State. There is only one power that can save the people of Utah from unnecessary disease and death, and that is the people of Utah themselves. They are perfectly justified in looking to the organized medical profession of Utah, as represented by this State association, for guidance and expert knowledge and advice, but State public

health legislation or administration will never rise higher than the average of knowledge on this subject throughout the State. Public opinion, let it be emphasized once more, is the source and fountain of legislation and administration. No State association, no matter how active, and no public health officials, no matter how efficient, can possibly give to a State any better public health control than the mass of the people themselves desire. What are the specific advances which are needed in your State and in what order or manner these shall be taken up, is for you to determine. The responsibility for proper decisions on these points rests on you. Careful consideration should be given to your present situation and needs. The plans which you evolve should be such as will commend themselves to every intelligent, broad-minded, fair-thinking man and woman in your State. Personal jealousies or animosities, political ambitions, sectarian prejudices and scientific hobbies should have no place on such a program. Subjects should be taken up in the order of their relative importance with a view not only to securing legislation of value to-day, but also to laying a foundation for a permanent and effective health organization which will be a part of your State government for years to come. What form this will take, it is for you to determine. Whether a single commissioner, as in New York and Pennsylvania, whether a board composed of certain State officers *ex officio* and professional men appointed by the governor, as in Iowa, or whether a body like the Illinois State Board of Health, in which the law simply provides that the governor shall nominate and appoint seven persons, is a matter for careful study and consideration.

The determination of these and similar questions requires a knowledge and comparison of the laws in different States and of the experience of each State in administration. Such a task is too great for each State association to undertake. It can only be done by a central body. We have recently established, under the Council on Health and Public Instruction, a medico-legal bureau which will collect laws, ordinances, bills and reports on all public health subjects for the guidance and assistance of States desiring information. The present plans include, as a tentative list, the following:

1. State board of health law.
2. Vital statistic law.
3. Law authorizing a sanitary survey of the State and making an appropriation for it.

4. Medical practice act including the regulation of midwives and all sects treating the sick for compensation.

5. Law authorizing city and county health organizations with definite relations to each other and to the State board.

6. Food and drugs act.

7. Law regulating water supply, sewage and waste disposal.

8. Milk and dairy law.

9. Law providing for sanitary and health inspection of schools.

10. Industrial disease law.

Such a bureau is not intended in any sense as compulsory or dictatorial, but rather for the guidance and advice of those State associations, committees or persons who may desire assistance. On each subject, all the available material will be secured and carefully studied and a model bill drafted which will be widely circulated for criticisms and suggestions so that the resulting measure when completed will contain the combined wisdom and experience of all those interested.

But such a central bureau can only be advisory. Under our form of government, the greater part of the public health legislation and administration must come under the jurisdiction of the State government. However desirable and valuable may be a national department of health, it can never take the place of properly organized and administered State regulation of health matters. To the people of each State, then, the injunction must be to " work out your own salvation," for salvation from disease can come only through the education and the coöperation of the people. To you as physicians, and to your State association as your organized body, belongs the responsibility, as the possessors of scientific knowledge and as the representatives of the medical profession, of giving to your people the truth and of guiding them in the right direction in order that the results which they may reach may be the best possible results. This cannot be done through the use of political methods or machine tactics, by the use of personal influence or the exercise of despotic power, but can become possible only through you, as individuals and as an organization, embracing every possible opportunity to place by every available method the truth before your people in order that they, like the people in all ages, may know the truth and the truth may make them free.

BOOK REVIEWS.

ANNUAL REPORT OF THE INVESTIGATIONS OF THE THERAPEUTIC RESEARCH COMMITTEE OF THE COUNCIL ON PHARMACY AND CHEMISTRY OF THE AMERICAN MEDICAL ASSOCIATION, volume iii, 1914.

This report consists of eight papers which exhibit on every page evidence that careful and painstaking work has been undertaken to place the drugs studied in their proper niche.

We know of no better way to speak of these papers than to give the titles of the various subjects mentioned so that they may speak for themselves. By this we mean that a glimpse of these titles may awaken sufficient interest on the part of some pharmacists to become acquainted with the report as a whole. The work done by this Research Committee is of inestimable value to both the medical and pharmaceutical professions, and is bound to result in a more rational therapy. The titles are: "The Liberation of Formaldehyde from Hexamethylenamin in Pathologic Fluids." "The Mutual Action of Certain Digestive Ferments." "Studies in Cardiac Stimulants. I. Strychnine and Caffein Group." "Therapy of Cardiovascular Disturbances." "A Comparison of Methods for the Determination of the Proteolytic Activity of Pancreas Preparations." "The Present Status of Organic Iodin Preparations." "Clinical Studies in Caffein." "The Salicylates: A Historical and Critical Review of the Literature." This last paper is a particularly instructive and interesting *résumé* of what has been written on this drug.

JOHN K. THUM.

NEW AND NON-OFFICIAL REMEDIES, 1915: CONTAINING DESCRIPTIONS OF THE ARTICLES WHICH HAVE BEEN ACCEPTED BY THE COUNCIL ON PHARMACY AND CHEMISTRY OF THE AMERICAN MEDICAL ASSOCIATION PRIOR TO JANUARY 1, 1915.

Next to the Pharmacopœia itself, we know of no book that we refer to with more frequency, in the course of our work, than this useful little volume. The usefulness of this volume is further enhanced by the fact that it is revised every year and placed in the hands of the medical profession before the first quarter of the year has passed. Pharmacists can certainly appreciate this; we have never been treated to such celerity in the revision of our pharmacopœia. Would not the United States Pharmacopœia, and all pharma-

copœias, for that matter, be regarded with more favor by physicians if it was revised in like manner? Five years have passed since the last pharmacopœial convention, and the forthcoming pharmacopœia has not yet come forth.

A method of grouping remedies and substances of more or less similarity has been elaborated upon in the present revision and is a distinct advantage. This method enables one to see at a glance the comparative value and usefulness of the various therapeutic agents of which this book consists. J. K. T.

CURRENT LITERATURE.

Agricultural Alcohol.

Edward Kremers, in Bulletin of the U. S. Department of Agriculture No. 182, presents a report of his studies on the manufacture of agricultural alcohol in Germany. In this study all phases of the subject have been studied by the author, including the taxation question, the distribution of the finished product, and, lastly, the basic question, which was to determine the most profitable article for the production of agricultural alcohol. The potato has been found to be the most profitable for several reasons: *i.e.*, that all the ingredients taken from the soil by the potato are returned to the soil; the product left after the starch has been converted into alcohol is valuable as a food for cattle; other crops can be introduced into the rotation, and, lastly, it gives the farmer a chance to convert the unstable potato crop into a stable article, thereby avoiding an unecessary loss. The reports of the personal visits to several agricultural distilleries, which occupy about one-half of the pamphlet, are of very great importance and interest because the author has made a very careful study of the work as carried on at the various distilleries, bringing forth many facts which will be of importance to the investigators on this subject. A. H.